A SUPPLEMENT TO HUTTON'S ARITHMETIC:

CONTAINING

THE SOLUTIONS, AT FULL LENGTH,

OF THE

PROMISCUOUS COLLECTION OF QUESTIONS

PROPOSED IN THAT WORK.

BY THE AUTHOR.

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ADVERTISEMENT.

THE promiſcuous collection of queſtions propoſed in the Arithmetic, was intended for the exerciſe of pupils after they had gone through the ſeveral rules of the book, and has been found very uſeful to them, by accuſtoming them to think, and to ſtrike out methods of ſolution unaſſiſted by other helps. But many gentlemen having expreſſed a deſire to have a publication of the ſolutions of thoſe queſtions at full length, that they might have the ſatisfaction to compare their own ſolutions with thoſe of the Author, and thereby the opportunity of chuſing which they like beſt, he has herein complied with their requeſt.

Theſe ſolutions are publiſhed apart from the work itſelf, that the teacher may avail himſelf of them, and yet keep them from the ſight of his pupils if he ſo chuſes, each learner having only the book of arithmetic for the purpoſes therein mentioned.

The ſolutions are all delivered in what have been judged to be the beſt forms. Sometimes two methods are given, where they ſeemed neceſſary. In ſuch of them as contain any proportions, or rule-of-three ſtatings, the fourth term is generally put down in the form of a vulgar fraction, placing the product of the ſecond and third terms, as numerator, to be

divided by the firſt as a denominator; the fraction is then abbreviated as much as it can be, before the multiplication and diviſion are performed; by which means generally theſe two operations are intirely ſaved, or at leaſt much ſhortened and facilitated, by bringing them to ſuch ſmall numbers as can be eaſily multiplied and divided mentally, and the anſwer thence diſcovered without any other intermediate figures or operations to be written down. So that there is never occaſion for more writing than appears in the operations as here printed, where it will be found that, to avoid the long form of diviſion, the large diviſors are ſeparated into their component parts, and the diviſions performed ſeparately by them, which are always done by writing down only the quotients. But where the numbers are ſo large as to make long diviſions, or multiplications, unavoidable, thoſe operations are always placed down at the bottom of the ſolution, that ſo none of the neceſſary part of the writing in the full ſolution, might be omitted.

A PRO-

A PROMISCUOUS COLLECTION *of* QUESTIONS *and their* SOLUTIONS.

QUESTION I.

A WAS born when B was 21 years of age: how old will A be when B is 47; and what will be the age of B when A is 60? — — *Anſ.* A 26, B 81.

SOLUTION.

From	47	To	60
take	21	add	21
Anſ. — —	26 = A's age.		81 = B's age.

QUESTION 2.

What difference is there between twice five and twenty, and twice twenty-five? — — *Anſ.* 20.

SOLUTION.

From $50 = 2 \times 25 =$ twice 25,
take $30 = 2 \times 5 + 20 = 10 + 20 =$ twice 5 and 20, or = 20 and twice 5,
remains 20 = the anſwer.

QUESTION 3.

What number taken from the ſquare of 48 will leave 16 times 54? — — *Anſ.* 1440.

SOLUTION.

From	$2304 = 48^2$	48	54
take	$864 = 16 \times 54$	48	16
leaves	1440 the anſwer.	384	324
		192	54
		2304	864

OTHERWISE.

$48 \times 48 - 54 \times 16 = \overline{48 \times 3 - 54} \times 16 = \overline{144 - 54} \times 16$
$= 90 \times 16 = 1440$ the anſwer.

QUESTION 4.

What number added to the thirty-firſt part of 3813 will make the ſum 200? — — *Anſ.* 77.

SOLUTION.

200
31)3813(123 = the 31ſt part of 3813.
71
93 77 the anſwer.

OTHERWISE.

$$200 - \frac{3813}{31} = \frac{6200 - 3813}{31} = \frac{2387}{31} = 77.$$

QUESTION 5.

What number deducted from the 23d part of 29440 will leave the 64th part of the ſame? — *Anſ.* 820.

SOLUTION.

64)29440(460 23)29440(1280
384 64 460
184 ———
820 Anſ.

OTHERWISE.

$$\frac{29440}{23} - \frac{29440}{64} = 29440 \times \frac{64 - 23}{64 \times 23} = 3680 \times \frac{41}{8 \times 23}$$
$$= 460 \times \frac{41}{23} = 20 \times 41 = 820.$$

QUESTION 6.

The remainder of a diviſion is 325, the quotient 467, the diviſor is 43 more than the ſum of both; what is the dividend? — — — *Anſ.* 390270.

SOLUTION.

SOLUTION.

The answer or dividend here is to be found by multiplying the quotient by the divisor, and to the product adding the remainder. That is $\overline{325 + 467 + 43} \times 467 + 325 = 835 \times 467 + 325 = 389945 + 325 = 390270 =$ the dividend required.

Thus 325 the remainder
467 the quotient
43

835 the divisor
mult. by 467 the quotient

5845
5010
3340

389945 the product
325 the remainder

sum is 390270 the dividend or answer.

QUESTION 7.

A person, at the time of his out-setting in trade, owed 350l. and had in cash 5307l. 10s. in wares 713l. 7d. and in good debts 210l. 5s. 10d. Now after having traded a year he owed 703l. 17s. and had in cash 4874l. 9s. 4d. in bills 350l. in wares 1075l. 14s. $3\frac{1}{2}$d. and in recoverable debts 613l. 13s. $10\frac{1}{2}$d. What was his real gain that year? — — *Ans.* 329l. 4s. 1d.

SOLUTION.

SOLUTION.

L.	s.	d.	
5307	10	0	
713	0	7	
210	5	10	
6230	16	5	Effects
350	0	0	Debts
5880	16	5	Worth

L.	s.	d.	
4874	9	4	
350	0	0	
1075	14	$3\frac{1}{2}$	
613	13	$10\frac{1}{2}$	
6913	17	6	Effects
703	17	0	Debts
6210	0	6	Worth at the end
5880	16	5	Worth at beginning
329	4	1	Anſwer.

QUESTION 8.

Two perſons depart from the ſame place at the ſame time, the one travels 30, the other 35 miles a day: how far are they diſtant after 7 days if they travel both the ſame road, and how far if they travel in contrary directions? — — *Anſ.* 35 and 455 miles.

SOLUTION.

Here $\overline{35 - 30} \times 7 = 5 \times 7 = 35$ the anſwer in the 1ſt caſe.
And $35 + 30 \times 7 = 65 \times 7 = 455$ miles in the other.

QUESTION 9.

A gentleman's daily expence is 4l. 8s. $1\frac{19}{365}$d. and he ſaves 500l. in the year: What is his yearly income?

Anſ. 2107l. 12s.

SOLUTION.

Here the daily expence muſt be multiplied by 365 the days in year, and the 500l. added to the product. But 365 is $= 73 \times 5$, therefore multiply by 73 and by 5, as below.

L. s. d.

L.	s.	d.	
4	8	1	
		12	
52	17	0	for 12
		6	
317	2	0	for 72
4	8	1	for 1 add
321	10	1	for 73
		5	
1607	10	5	
	1	7	= 19 d. the product of the fraction.
1607	12	0	
500	0	0	
2107	12	0	the anſwer.

QUESTION 10.

Having a piece of land 11 poles in breadth, I demand what length of it muſt be taken to contain an acre, when 4 poles in breadth require 40 poles in length to contain the ſame? — — *Anſ.* 14 pls. 3 yds.

SOLUTION.

As $11 : 4 :: 40 : \frac{40 \times 4}{11} = \frac{160}{11} = 14\frac{6}{11}$ pls. = 14 p. 3 yds.

QUESTION 11.

If a gentleman, whoſe annual income is 1000 l. ſpend 20 guineas a week, whether will he ſave or run in debt, and how much in the year? — *Anſ.* 92 l. debt.

SOLUTION.

SOLUTION.

20 guineas = 21l.

52 weeks in a year

42
105

1092 ſpends *per* year
1000 income

92 debt.

QUESTION 12.

In the latitude of London, the diſtance round the earth, meaſuring in the parallel of latitude, is about 15550 miles; now as the earth turns round in 23 hours 56 minutes, at what rate *per* hour is the city of London carried by this motion from weſt to eaſt?

Anſ. $649\frac{250}{359}$ miles an hour.

SOLUTION.

h.	m.	h.	miles	miles
As 23	56 :	1 ::	15550	: $649\frac{250}{359}$ *per* hour, or nearly $6\frac{5}{8}$
60		60	60	[miles *per* minute.
4)1436		60	4)93300	
359			359)233250($649\frac{250}{359}$ Anſwer.	
			1785	
			3490	
			259	

QUESTION 13.

In order to raiſe a joint ſtock of 10000l. A, B, and C, together ſubſcribe 7950l. and D the reſt: now A and B are known together to have ſet their hands to 5800l. and A has been heard to ſay that he had undertaken for 550l. more than B. What did each proprietor advance?

Anſ. *A* 3175, *B* 2625, *C* 2150, *D* 2050.

SOLUTION.

SOLUTION.

First
5800 = A + B
550 subtr.
2)5250
2625 = B's
550 add
3175 = A's

Again
From 10000
take 7950 = A + B + C
leaves 2050 = D's

Lastly
From 7950 = A + B + C
take 5800 = A + B
leaves 2150 = C's

QUESTION 14.

A tradesman increased his estate annually by 100l. more than $\frac{1}{4}$ part of it, and at the end of 4 years found that his estate amounted to 10342l. 3s. 9d. What had he at out-setting? — — *Ans.* 4000l.

SOLUTION.

Here the amount at the end of each year, is equal to 100l. more than $\frac{1}{4}$ of what he had at the beginning of the same year; therefore subtract 100l. and there remains $\frac{5}{4}$ of what he had at the beginning of that year, consequently subtracting $\frac{1}{5}$ of this remainder from itself, there will at last remain the sum at the beginning of the year. And this operation must be made 4 times for the 4 years, as here follows.

L. s. d.

L.	s.	d.	
10342	3	9	at the end of the 4th year
100	0	0	ſubtract
5) 10242	3	9	
2048	8	9	= $\frac{1}{5}$ ſubtract
8193	15	0	= at the end of the 3d year
100	0	0	
5) 8093	15	0	
1618	15	0	
6475	0	0	end of the 2d year
100	0	0	
5) 6375	0	0	
1275	0	0	
5100	0	0	end of the 1ſt year
100	0	0	
5) 5000	0	0	
1000	0	0	
Anſ. 4000	0	0	at the beginning

QUESTION 15.

Paid 1012l. 10s. for 750l. taken in 7 years ago; at what rate *per cent. per ann.* did I pay intereſt? *Anſ.* 5l.

SOLUTION.

	L.	s.	
From	1012	10	the amount
take	750	0	the principal
7)	262	10	the intereſt for 7 years
	37	10	ditto - - - 1 year

Then as 750 : 100
Or as 15 : 2
} :: $37\frac{1}{2} : \frac{75}{15}$ = 5 *per cent.* the anſwer.

QUESTION

QUESTION 16.

What is the intereſt of 720l. for 73 days, or $\frac{1}{5}$ of a year, at 3l. *per cent. per annum?* — *Anſ.* 4l. 6s. 4d. $3\frac{1}{5}$q.

SOLUTION.

$$\left.\begin{matrix}100\\1\end{matrix}\right\} : 3 :: \left\{\begin{matrix}720\\\frac{1}{5}\end{matrix}\right\} : \frac{72\times 3}{50} = \frac{36\times 3}{25} = \frac{108}{25} = \frac{21\text{l. }12\text{s.}}{5}$$

$= \text{L.}\,4\,.\,6\,.\,4\,.\,3\frac{1}{5}$ the anſwer.

QUESTION 17.

Part 1200 acres of land among A, B, and C, ſo that B may have 100 more than A, and C 64 more than B?

Anſ. *A* 312, *B* 412, *C* 476.

SOLUTION.

100 = B more than A
164 = C more than A

the ſum 264
take from 1200

3) 936
312 = A's
add 100

412 = B's
add 64

476 = C's.

QUESTION 18.

Divide 1000 crowns, give A 120 more and B 95 leſs than C. — — *Anſ.* *A* 445, *B* 230, *C* 325.

SOLUTION.

95 = C more than B
215 = A more than B

the ſum 310
take from 1000

3) 690
230 = B's
add 95

325 = C's
add 120

445 = A's.

QUESTION 19.

To how much amounts the order, for which my factor, at the rate of $2\frac{1}{2}$ *per cent.* receives 22l. 10s? — *Anſ.* 900l.

SOLUTION.

As $2\frac{1}{2} : 22\frac{1}{2} :: 100 : \frac{100 \times 22\frac{1}{2}}{2\frac{1}{2}} = \frac{100 \times 45}{5} = 900$l. the anſwer.

QUESTION 20.

What ſum of money will amount to 132l. 16s. 3d. in 15 months, at 5 *per cent. per annum* ſimple intereſt?

Anſ. 125l.

SOLUTION.

As 12 : 15, or as 4 : 5 :: 5 : $\frac{25}{4} = 6\frac{1}{4}$ = the intereſt of 100l. for 15 months.

And therefore $106\frac{1}{4} = \frac{425}{4}$ = the amount of 100l. for the ſame time.

Hence

Hence $\frac{425}{4}$: L. 132 s. 16 d. 3 $= 132\frac{13}{16} = \frac{2125}{16}$: : 100 :

$\frac{25 \quad 5}{100 \times 2125 \times 4} = 125$ l. the answer.
$\frac{16 \times 425}{4}$

QUESTION 21.

Laid out 165l. 15s. in wine at 4s. 3d. a gallon; ſome of which receiving damage in carriage, I ſold the reſt at 6s. 4d. a gallon, which produced only 110l. 16s. 8d. What quantity was damaged? — *Anſ.* 430 gal.

SOLUTION.

	s.	d.		L.	s.	d.	gal.	gallons
As	6	4	:	110	16	8	: : 1	: 350
	12			20				
	76			2216				
				12				
				26600				

76)26600(350 gallons ſold.
380

	s.	d.		L.	s.		gal.	gallons
And as	4	3	:	165	15	: :	1	: 780
	12			20				
	51			3315				
				12				
				39780				

51)39780(780 bought
408 350 ſold, ſubtract

Anſ. 430 gallons unſold, or damaged.

QUESTION 22.

A father divided his fortune among his ſons, giving A 4 as often as B 3, and C 5 as often as B 6; what was the whole legacy, ſuppoſing A's ſhare were 5000l.

Anſ. 11875l.

SOLUTION.

A having 4 for B's 3, is the ſame as A 8 for B 6; and C had 5 for B's 6. Therefore

As $8 : 8+6+5 = 19 :: 5000 : \frac{5000 \times 19}{8} = 625 \times 19$
$= 11875$l. the anſwer.

QUESTION 23.

A ſtationer ſold quills at 10s. 6d. a thouſand, by which he cleared $\frac{1}{3}$ of the money; but growing ſcarce, raiſed them to 12s. a thouſand; what did he clear *per cent.* by the latter price? —— *Anſ.* 71l. 8s. $6\frac{6}{7}$d.

SOLUTION.

	s.	d.	
	3)10	6	
ſubtract	3	6	gain at firſt
ſubtr.	7	0	prime coſt
from	12	0	
leaves	5	0	the laſt gain.

Therefore as $7 : 5 :: 100 : \frac{500}{7} = 71\frac{3}{7} =$ L.71 8 $6\frac{6}{7}$ the anſwer.

QUESTION 24.

If 1000 men, beſieged in a town, with proviſions for 5 weeks, allowing each man 16 oz a day, were reinforced with 500 men more; and hearing that they cannot be relieved till the end of 8 weeks; how many ounces a day muſt each man have, that the proviſion may laſt that time? — — — *Anſ.* $6\frac{2}{3}$ oz.

SOLUTION.

$$\left.\begin{matrix}1500\\8\end{matrix}\right\} \text{oz.} : 16 :: \left\{\begin{matrix}1000\\5\end{matrix}\right\} : \frac{5 \times 10 \times 16^{2}}{8 \times 15_{3}} = \frac{20}{3} = 6\tfrac{2}{3} \text{ oz.}$$

the anſwer.

QUESTION

QUESTION 25.

If a quantity of provisions serve 1500 men 12 weeks, at the rate of 20 ounces a day for each man; how many men will the same provisions maintain for 20 weeks, at the rate of 8 oz. a day for each man? — *Ans.* 2250 men.

SOLUTION.

$$\left.\begin{matrix}20\\8\end{matrix}\right\}\text{men} : 1500 :: \left\{\begin{matrix}12\\20\end{matrix}\right\} : \frac{\overset{3}{\cancel{20}} \times \cancel{12} \times \overset{750}{\cancel{1500}}}{\underset{2}{\cancel{20}} \times \cancel{8}} = 2250 \text{ men, the answer.}$$

QUESTION 26.

In what time will the interest of 72l. 12s. equal that of 15l. 5s. for 64 days, at any rate of interest?

Ans. $13\frac{161}{363}$ days.

SOLUTION.

Here $\overset{\text{L.}}{72}\ \overset{\text{s.}}{12} = 72\frac{12}{20} = 72\frac{3}{5} = \frac{363}{5}$l.

And $15\ \ 5 = 15\frac{5}{20} = 15\frac{1}{4} = \frac{61}{4}$.

Then as $\frac{363}{5} : 64 :: \frac{61}{4} : \frac{61 \times \overset{16}{\cancel{64}} \times 5}{4 \times 363} = \frac{4880}{363} = 13\frac{161}{363}$ days, the answer.

QUESTION 27.

A person possessed of $\frac{3}{8}$ of a ship, sold $\frac{2}{3}$ of his share for 1260l. what was the reputed value of the whole at the same rate? —— —— *Ans.* 5040l.

SOLUTION.

First $\frac{2}{3}$ of $\frac{3}{8} = \frac{\cancel{2} \times \cancel{3}}{\cancel{3} \times \underset{4}{\cancel{8}}} = \frac{1}{4}$ the part sold.

Then $\frac{1}{4} : 1 :: 1260 : 1260 \times 4 = 5040$l. the value of the whole ship.

QUESTION 28.

What ſum of money at $4\frac{1}{2}$ *per cent.* will clear 29l. 15s. in a year and a half's time? — *Anſ.* 440l. 14s. $9\frac{7}{9}$d.

SOLUTION.

Firſt $4\frac{1}{2} = \frac{9}{2}$,

and 29l. 15s. $= 29\frac{3}{4} = \frac{119}{4}$ l.

alſo $1\frac{1}{2} = \frac{3}{2}$.

Then $\frac{9}{2} \times \frac{3}{2} : 100 :: \frac{119}{4} \times 1 : \frac{119 \times 100 \times 1 \times 1}{4 \times 3 \times 9} = \frac{11900}{3 \times 9} = \frac{3966\text{l. } 13\text{s. } 4\text{d.}}{9} =$ L. 440 . 14 . $9\frac{7}{9}$ the principal required.

QUESTION 29.

What number is that, to which if $\frac{2}{7}$ of $\frac{5}{9}$ be added, the ſum will be 1? — — *Anſ.* $\frac{53}{63}$.

SOLUTION.

Firſt $\frac{2}{7}$ of $\frac{5}{9} = \frac{2 \times 5}{7 \times 9} = \frac{10}{63}$.

Then $1 - \frac{10}{63} = \frac{63}{63} - \frac{10}{63} = \frac{53}{63}$ the anſwer.

QUESTION 30.

A father dying, left his ſon a fortune, $\frac{1}{4}$ of which he ran through in 8 months; $\frac{3}{7}$ of the remainder laſted him a twelve-month longer, after which he had bare 410l. left: What did his father bequeath him?

Anſ. 956l. 13s. 4d.

SOLUTION.

After ſpending $\frac{1}{4}$ he had $\frac{3}{4}$ remaining.

And after ſpending $\frac{3}{7}$ of the remainder he had $\frac{4}{7}$ of that remainder left.

Therefore

Therefore $\frac{4}{7}$ of $\frac{3}{4} = \frac{3}{7}$ of the whole left at laſt, the value of which is 410l.

Hence $\frac{3}{7} : 410 :: 1 : \frac{410 \times 7}{3} = \frac{2870}{3} =$ L. 956 . 13 . 4 the whole ſum bequeathed.

QUESTION 31.

Bought a quantity of goods for 250l. and 3 months after ſold it for 275l. How much *per cent. per annum* did I gain by them? — — *Anſ.* 40.

SOLUTION.

Here 275 — 250 = 25 the gain of 250 for 3 months.

Therefore as $250 \times 3 : 25 :: 100 \times 12 : \frac{\overset{4}{\cancel{12}} \times 10 \times \cancel{100}}{3 \times \cancel{100}} =$ 40 *per cent. per annum* gained.

QUESTION 32.

A guardian paid his ward 3500l. for 2500l. which he had in his hand 8 years: What rate of intereſt did he allow him? — — *Anſ.* 5 *per cent.*

SOLUTION.

Here 3500 — 2500 = 1000 the intereſt of 2500 for 8 years.

Therefore $2500 \times 8 : 1000 :: 100 \times 1 : \frac{\cancel{1000} \times \overset{125}{\cancel{1000}}}{\cancel{8} \times \cancel{2500}} =$ 5 *per cent.*

QUESTION 33.

Bought a quantity of goods for 150l. ready money, and ſold it again for 200l. payable at the end of 9 months; what was the gain in ready money, ſuppoſing rebate to be made at 5 *per cent.* — *Anſ.* 42l. 15s. $5\frac{5}{83}$d.

SOLUTION.

As $12 : 5 :: 9 : \frac{\overset{3}{\cancel{9}} \times 5}{\cancel{12}_{4}} = \frac{15}{4}$ the intereſt of 100l. for 9 months.

And therefore $100\frac{15}{4} = \frac{415}{4}$ = its amount for that time.

Then $\frac{415}{4} : 100 :: 200 : \frac{\overset{40}{\cancel{200}} \times 100 \times 4}{\cancel{415}_{83}} = \frac{16000}{83} =$ the preſent worth of the 200l.

Conſequently $\frac{16000}{83} - 150 = \frac{16000 - 12450}{83} = \frac{3550}{83}$

83)3550(42l. = L.42 . 15 . $5\frac{5}{83}$ the gain in ready money.
230
64
20

83)1280(15s.
450
35
12

83) 420 (5d.
5

QUESTION 34.

A perſon being aſked the hour of the day, ſaid, The time paſt noon is equal to $\frac{4}{5}$ths of the time till midnight: What was the time? — *Anſ.* 20 min. paſt 5.

SOLUTION.

Here the one part of the 12 hours, which are contained between noon and midnight, being $\frac{4}{5}$ of the other, the two parts are in the ratio of 4 to 5.

Hence

Hence as $4+5=9:4::12:\frac{\cancel{12}^{4}\times 4}{\cancel{9}_{3}}=\frac{16}{3}=5\frac{1}{3}$ hrs.
$=5$ h. 20 min. the time paſt noon required.

QUESTION 35.

A perſon, looking on his watch, was aſked what was the time of the day, who anſwered, It is between 4 and 5; but a more particular anſwer being required, he ſaid that the hour and minute hands were then exactly together: What was the time? — *Anſ.* $21\frac{9}{11}$ min. paſt 4.

SOLUTION.

As the minute hand goes once round while the hour hand goes but $\frac{1}{12}$ part, in every revolution of the former, it goes $\frac{11}{12}$ more than the latter.

Now when the firſt is at 12, the latter is at 4, and therefore the next time the former overtakes the latter, it will have gone 4 parts of the 12 more than this other.

Then ſtate the increaſes proportional to the diſtances, as here below.

As $11:4::60$ min. $:\frac{60\times 4}{11}=\frac{240}{11}=21\frac{9}{11}$ min. paſt 4, the time ſought.

QUESTION 36.

With 12 gallons of canary at 6s. 4d. a gal. I mixed 18 gal. of white-wine at 4s. 10d. a gal. and 12 gal. of cyder at 3s. 1d. a gal. At what rate muſt I ſell a quart of this compoſition ſo as to clear 10 *per cent.* *Anſ.* 1s. $3\frac{5}{7}$d.

SOLUTION.

gal.	s.	d.	s.	
12 ×	6	4 =	76	Then as 100 : 10 :: 200s. : 20s gain.
18 ×	4	10 =	87	Theref. the 42g. or 168q. muſt ſell for 220s.
12 ×	3	1 =	37	Conſeq. as 168 : 220 :: 1 : $\frac{220}{168}=\frac{55}{42}=$
Theref. 42 gal. coſt 200s.				$\frac{9s.\ 2d.}{7}=$ 1s. $3\frac{5}{7}$d. *per* quart, ſo as to gain 10 *per cent.*

QUESTION

QUESTION 37.

Suppoſe that I have $\frac{3}{16}$ of a ſhip worth 1200l. what part of her have I left after ſelling $\frac{2}{5}$ of $\frac{4}{9}$ of my ſhare, and what is it worth? —— *Anſ.* $\frac{37}{240}$ worth 185l.

SOLUTION.

$\frac{2}{5}$ of $\frac{4}{9} = \frac{2 \times 4}{5 \times 9} = \frac{8}{45}$ the part of his ſhare, or of $\frac{3}{16}$ which is ſold. But when $\frac{8}{45}$ of any thing is deducted, there remains $\frac{37}{45}$ of the ſame thing. Therefore $\frac{37}{45}$ of $\frac{3}{16}$ $= \frac{37 \times 3}{45 \times 16} = \frac{37}{240}$ is the part of the ſhip remaining.

OTHERWISE.

$\frac{8}{45}$ of $\frac{3}{16} = \frac{8 \times 3}{45 \times 16} = \frac{1}{30}$ = the part of the ſhip ſold.

Therefore $\frac{3}{16} - \frac{1}{30} = \frac{45 - 8}{240} = \frac{37}{240}$ = the part of the ſhip remaining, the ſame as before.

Then, as $1 : \frac{37}{240} :: 1200 : \frac{1200 \times 37}{240} = 5 \times 37 =$ 185l. the value of the part remaining.

QUESTION 38.

What length muſt be cut off a board $8\frac{3}{8}$ inches broad, to contain a ſquare foot, or as much as 12 inches in length and 12 in breadth? —— *Anſ.* $17\frac{13}{67}$ inches.

SOLUTION.

As $8\frac{3}{8} = \frac{67}{8} : 12 :: 12 : \frac{12 \times 12 \times 8}{67} = \frac{1152}{67} = 17\frac{13}{67}$ inches in length to be cut off.

67)1152(17

67)1152(17
482
13

QUESTION 39.

What sum of money will produce as much interest in $3\frac{1}{4}$ years, as 210l. 3s. can produce in 5 years and 5 months? — — *Ans.* 350l. 5s.

SOLUTION.

First $3\frac{1}{4} = \frac{13}{4}$,

and 5 y. 5 m. $= 5\frac{5}{12} = \frac{65}{12}$,

also 210l. 3s. $= 210\frac{3}{20} = \frac{4203}{20}$.

Then as $\frac{13}{4} : \frac{65}{12} :: \frac{4203}{20} : \frac{4203 \times \cancel{65}^{5} \times 4}{\cancel{20} \times 12 \times \cancel{13}} = \frac{1401}{4}$
$= 350\frac{1}{4}$l. = 350l. 5s. the sum required.

QUESTION 40.

There is gained by trading with a ship 120l. 14s. Now suppose that $\frac{1}{4}$ of her belongs to S, $\frac{3}{8}$ to T, $\frac{1}{8}$ to V, and the rest to W; what must each have of the gain? — *Ans.* *S* 30l. 3s. 6d. *T* 45l. 5s. 3d. *V* 15l. 1s. 9d. *W* 30l. 3s. 6d.

SOLUTION.

First $\frac{1}{4} + \frac{3}{8} + \frac{1}{8} = \frac{2+3+1}{8} = \frac{6}{8}$ = the sum of S, T, and V's.

Therefore $1 - \frac{6}{8} = \frac{2}{8}$ = W's share, which is the same as that of S. Also their respective shares are proportional to the numerators of the fractions, viz. to the numbers 2, 3, 1, 2, the sum of which is 8. Then

as 8 : 120l. 14s.
or as 1 : 15l. 1s. 9d. ::

2 :	30l.	3s.	6d.	= S's share
3 :	45	5	3	= T's
1 :	15	1	9	= V's
2 :	30	3	6	= W's

their sum is 120 . 14 . 0 = the sum given.

QUESTION 41.

If 100l. in 5 years be allowed to gain 20l. 10s. in what time will any ſum of money double itſelf at the ſame rate of intereſt? — *Anſ.* $24\frac{16}{41}$ years.

SOLUTION.

Here it is only to find the time in which 100l. will gain 100l. which is thus.

As 20l. 10s. $= 20\frac{1}{2}$l. $= \frac{41}{2}$: 100 : : 5 years :

$\frac{100 \times 5 \times 2}{41} = \frac{1000}{41} = 24\frac{16}{41}$ years, the anſwer.

41)1000(24
180
16

QUESTION 42.

What difference is there between the intereſt of 350l. at 4 *per cent.* for 8 years, and the diſcount of the ſame ſum, at the ſame rate, and for the ſame time?

Anſ. 27l. $3\frac{1}{33}$s.

SOLUTION.

Firſt $4 \times 8 = 32$ is the intereſt of 100l. for the 8 years.

Then $132 : 32 :: 350 : \frac{350 \times 32}{132} = \frac{2800}{33}$ = the diſc. of 500.

And $100 : 32 :: 350 : \frac{350 \times 32}{100} = 112$ = the intereſt of 350.

Therefore $112 - \frac{2800}{33} = \frac{3696 - 2800}{33} = \frac{896}{33} = \frac{298\text{l. } 13\frac{1}{3}\text{s.}}{11} = 27\text{l. } 3\frac{1}{33}\text{s.}$ = the difference required.

QUESTION

QUESTION 43.

If, by selling goods at 50s. *per cwt.* I gain 20 *per cent.* what do I gain or lose *per cent.* by selling at 45s. *per cwt.*? *Ans.* 8l. gain.

SOLUTION.

As $5\not{0} : 12\not{0} :: 45 : \frac{45 \times 12}{5} = 108$ = the amount or returns of 100 at the rate of 45 *per cwt.*

Therefore $108 - 100 = 8$ is the gain *per cent.*

QUESTION 44.

If, by remitting to Holland, at 34s. 6d. *per* l. sterling, $4\frac{1}{2}$ *per cent.* be gained; how goes the exchange, when by remittance I clear 10 *per cent.*? *Ans.* 36s. $3\frac{165}{209}$d.

SOLUTION.

First 34s. 6d. $= 34\frac{1}{2} = \frac{69}{2}$,

And $100 + 4\frac{1}{2} = 104\frac{1}{2} = \frac{209}{2}$.

Then $\frac{209}{\not{2}} : \frac{69}{\not{2}} :: 110 : \frac{110 \times 69}{209} = \frac{7590}{209} =$ 36s. $3\frac{165}{209}$d. the rate of exchange to gain 10 *per cent.*

209)7590(36s.
1320
66
12

209) 792 (3d.
165

QUESTION 45.

Sold goods for 60 guineas, and by ſo doing, loſt 17 *per cent.* whereas I ought, in dealing, to have cleared 20 *per cent.* Then how much under their juſt value were they ſold? —— —— *Anſ.* 28l. 1s. $8\frac{20}{83}$d.

SOLUTION.

Firſt $100 + 20 = 120$,
and $100 - 17 = 83$,
their difference is $120 - 83 = 37$;
alſo 60 guineas $= 63$l.

Then $83 : 37 :: 63 : \frac{63 \times 37}{83} = \frac{2331}{83} = 28$l. 1s. $8\frac{20}{83}$d. the anſwer.

63
37
441
189
2331
83)2331(28l.
671
7
20
140
83)140(1s.
57
12
684
83)684(8d.
20

QUESTION 46.

If, by ſelling goods at 27d. *per* lb. I gain *cent. per cent.* what do I clear *per cent.* by ſelling for 9 guineas *per cwt?* —— —— *Anſ.* 50 *per cent.*

SOLUTION.

At 27d. *per* lb. it is *per cwt.* 27×112d. $= 9 \times 28$s.
And 9 guineas $= 9 \times 21$s.

Therefore

Therefore $9 \times 28 : 9 \times 21 :: 200 : \frac{\overset{50}{\cancel{200}} \times \overset{3}{\cancel{21}}}{\underset{4}{\cancel{28}}} = 150$

the amount of 100 at the latter price.

Conſequently $150 - 100 = 50 =$ the gain *per cent.*

QUESTION 47.

If 20 men can perform a piece of work in 12 days, how many will accompliſh another thrice as big in one-fifth of the time? —— —— *Anſ.* 300.

SOLUTION.

As $1 \times \frac{1}{5} : 20 :: 3 \times 1 : 3 \times 20 \times 5 = 300$ men the anſwer.

QUESTION 48.

A younger brother received 6300l. which was juſt $\frac{7}{9}$ of his elder brother's fortune: What was the father worth at his death? —— —— *Anſ.* 14400l.

SOLUTION.

As the one was $\frac{7}{9}$ of the other, their ſhares were to each other, as 7 is to 9. Therefore

As $7 : 7 + 9 = 16 :: 6300 : 16 \times 900 = 14400$l. the anſwer.

QUESTION 49.

A perſon making his will, gave to one child $\frac{13}{20}$ of his eſtate, and the reſt to another; and when theſe legacies came to be paid, the one turned out 600l. more than the other: What did the teſtator die worth? — *Anſ.* 2000l.

SOLUTION.

As the one had $\frac{13}{20}$, the other muſt have had $\frac{7}{20}$, and their ſhares in the ratio of 13 to 7. Therefore

As $13 - 7 = 6 : 13 + 7 = 20 :: 600 : 100 \times 20 =$ 2000l. the whole eſtate.

QUESTION 50.

A father deviſed $\frac{7}{18}$ of his eſtate to one of his ſons, and $\frac{7}{18}$ of the reſidue to another, and the ſurplus to his relict for life: the children's legacies were found to be 257l. 3s. 4d. different: Pray what money did he leave the widow the uſe of? —— *Anſ.* 635l. $10\frac{30}{49}$d.

SOLUTION.

Firſt, $1 - \frac{7}{18} = \frac{11}{18}$ = the reſidue after the 1ſt ſhare.

Therefore $\frac{7}{18}$ of $\frac{11}{18} = \frac{77}{324}$ = the 2d ſon's ſhare.

And $\frac{7}{18} - \frac{77}{324} = \frac{126 - 77}{324} = \frac{49}{324}$ the difference of the ſons' ſhares.

Alſo ſince $18 - 7 = 11$, we have $\frac{11}{18}$ of $\frac{11}{18} = \frac{121}{324}$ = the proportional ſhare of the relict.

Conſeq. as 49 : 121 : : 257l. 3s. 4d. : 635l. os. $10\frac{30}{49}$d.

$121 = 11 \times 11$ $\quad$ 11

$49 = 7 \times 7$. $\quad$ 2828 16 8

11

7) 31117 3 4

7) 4445 6 $2\frac{2}{7}$

635 o $10\frac{30}{49}$ the anſwer.

QUESTION 51.

What number is that, from which, if you take $\frac{2}{7}$ of $\frac{3}{8}$, and to the remainder add $\frac{7}{16}$ of $\frac{1}{20}$, the ſum will be 10?

Anſ. $10\frac{191}{2240}$.

SOLUTION.

Firſt $\frac{2}{7}$ of $\frac{3}{8} = \frac{2 \times 3}{7 \times 8} = \frac{3}{28}$.

4

And $\frac{7}{16}$ of $\frac{1}{20} = \frac{7}{320}$.

Therefore

Therefore $10 - \frac{7}{320} + \frac{3}{28} = \frac{22400 - 49 + 240}{2240} =$

$\frac{22640 - 49}{2240} = \frac{22591}{2240} = 10\frac{191}{2240}$ = the anſwer.

QUESTION 52.

There is a number which, if multiplied by $\frac{2}{3}$ of $\frac{7}{8}$ of $1\frac{1}{2}$, will produce 1: What is the ſquare of that number?

Anſ. $1\frac{15}{49}$.

SOLUTION.

Here $1 \div \frac{2}{3}$ of $\frac{7}{8}$ of $1\frac{1}{2} = 1 \div \frac{2 \times 7 \times 3}{3 \times 8 \times 2} = 1 \times \frac{8}{7} = \frac{8}{7}$

= the number.

And theref. $\frac{8}{7} \times \frac{8}{7} = \frac{64}{49} = 1\frac{15}{49}$ = the ſq. of the numb.

QUESTION 53.

A perſon dying, left his wife with child, and making his will, ordered that if ſhe went with a ſon, $\frac{2}{3}$ of his eſtate ſhould belong to him, and the remainder to his mother; and if ſhe went with a daughter, he appointed the mother $\frac{2}{3}$ and the girl the remainder: but it happened that ſhe was delivered both of a ſon and daughter; by which ſhe loſt in equity 24col. more than if it had been only a girl: What would have been her dowry had ſhe had only a ſon? — — *Anſ.* 2100l.

SOLUTION.

Since the ſon's ſhare is to the mother's, as 2 to 1, and the mother's to the daughter's, as 2 to 1; therefore their three ſhares are reſpectively as the numbers 4, 2, and 1, the ſum of which is 7. Conſequently their real ſhares are $\frac{4}{7}$, $\frac{2}{7}$, and $\frac{1}{7}$.

Now $\frac{2}{3} - \frac{4}{7} = \frac{14 - 6}{21} = \frac{8}{21}$.

Theref. $\frac{8}{21} : \frac{1}{3} :: 2400 : \frac{2400 \times 21}{3 \times 8} = 2100$ the anſw.

QUESTION 54.

Three perſons purchaſe together a ſhip, toward the payment of which A advanced $\frac{2}{9}$, and B $\frac{2}{7}$ of the value, and C 200l. How much paid A and B, and what part of the veſſel had C?—*Anſ.* *A* $90\frac{10}{31}$l. *B* $116\frac{4}{31}$l. *C* $\frac{31}{63}$ part.

SOLUTION.

First $1 - \frac{2}{9} - \frac{2}{7} = 1 - \frac{14}{63} - \frac{18}{63} = 1 - \frac{32}{63} = \frac{31}{63}$ = C's part.

Conſequently as 31 : 200 ::

$$\begin{cases} 14 : \frac{14 \times 200}{31} = \frac{2800}{31} = 90\frac{10}{31} \text{ paid by A,} \\ 18 : \frac{18 \times 200}{31} = \frac{3600}{31} = 116\frac{4}{31} \text{ paid by B.} \end{cases}$$

QUESTION 55.

A and B clear by an adventure at ſea, 60 guineas, with which they agree to buy a horſe and chaiſe, of which they were to have the uſe, in proportion to the ſums adventured, which was found to be A 9 to B 8; they cleared 45 *per cent.* What money then did each ſend abroad?

Anſ. *A* 74l. 2s. $4\frac{4}{17}$d. and *B* 65l. 17s. $7\frac{13}{17}$d.

SOLUTION.

First $45 : 100 :: 63 : \frac{\overset{7}{\cancel{63}} \times \overset{20}{\cancel{100}}}{\underset{5}{\cancel{45}}} = 140$l. = the ſum of the adventures.

Therefore as $8 + 9 = 17 : 140$ ::

$$\begin{cases} 8 : \frac{8 \times 140}{17} = 81.\ 4s.\ 8\frac{8}{17}d. \times 8 = 65l.\ 17s.\ 7\frac{13}{17}d. = B's, \\ 9 : \frac{9 \times 140}{17} = 81.\ 4s.\ 8\frac{8}{17}d. \times 9 = 74l.\ 2s.\ 4\frac{4}{17}d. = A's. \end{cases}$$

17)140(81.

17)140(8l.
4
20
17) 80(4s.
12
12
17)144(8$\frac{5}{17}$d.
8

QUESTION 56.

In an article of trade, A gains 18s. 3d. and his adventure was 40s. more than B's, whose ſhare of profit is but 12s. What are the particulars of their ſtock?

Anſ. *A* 5l. 16s. 9$\frac{3}{5}$d. and *B* 3l. 16s. 9$\frac{3}{5}$d.

SOLUTION.

The difference of the adventures being 40s. and the difference of the gains = 18s. 3d. — 12s. = 6s. 3d. = 6$\frac{1}{4}$s. = $\frac{25}{4}$.

Therefore as $\frac{25}{4}$: 40, or as 25 : 160, or as 5 : 32 : :

$$\begin{cases} 18\frac{1}{4} = \frac{73}{4} : \frac{73 \times 32}{4 \times 5} = \frac{584}{5} = 116\frac{4}{5}\text{s.} = 5\text{l. } 16\text{s. } 9\frac{3}{5}\text{d.} = \text{A's.} \\ 12 \quad : \frac{12 \times 32}{5} = \frac{384}{5} = 76\frac{4}{5}\text{s.} = 3\text{l. } 16\text{s. } 9\frac{3}{5}\text{d.} = \text{B's.} \end{cases}$$

QUESTION 57.

Three perſons entered joint trade, to which A contributed 240l. and B 210l. they clear 120l. of which 30l. belongs of right to C. Required that perſon's ſtock, and the ſeveral gains of the other two?

Anſ. *C*'s ſtock 150l. *A* gained 48l. and *B* 42l.

SOLUTION.

Firſt 120 — 30 = 90 = the ſum of the gains of A and B.
And 240 + 210 = 450 = the ſum of their ſtocks.

Therefore, as 450 : 90, or as 5 : 1 : :

$$\begin{cases} 240 : \frac{240}{5} = 48 = \text{A's gain,} \\ 210 : \frac{210}{5} = 42 = \text{B's gain.} \end{cases}$$

Alſo, as 90 : 450, or as 1 : 5 : : 30 : 150 = C's ſtock.

QUESTION 58.

A and B in partnerſhip equally divide the gain; A's money, which was 96l. 12s. lay for 15 months, and B's for no more than 6: What was the adventure of the latter? —— —— *Anſ.* 241l. 10s.

SOLUTION.

Since the two ſhares of the gain are equal, by the rule of Double-Fellowſhip it appears that the two products are equal which are made by multiplying each ſtock by its time, and conſequently that the ſtocks are inverſely or reciprocally as the times. Hence

As 6 : 15, or as 2 : 5 : : 96l. 12s. : 48l. 6s. × 5 = 241l. 10s. = the ſum adventured by B.

QUESTION 59.

Put out 420l. to intereſt, and in $6\frac{1}{2}$ years time there was found to be due 556l. 10s. What was the rate of intereſt? —— —— *Anſ.* 5 *per cent.*

SOLUTION.

Firſt $556\frac{1}{2} - 420 = 136\frac{1}{2}$ = the intereſt of 420 for $6\frac{1}{2}$ yrs.
Theref. $136\frac{1}{2} \div 6\frac{1}{2} = 273 \div 13 = 21$ = its intereſt for 1 yr.
Then as 420 : 21, or as 20 : 1 : : 100 : 5.
Therefore the rate of intereſt was 5 *per cent.*

QUESTION 60.

A clears 12l. in 6 months, B 15l. in 5 months, and C, whoſe ſtock was 40l. clears 21l. in 9 months: What was the whole ſtock? —— —— *Anſ.* $125\frac{5}{7}$l.

SOLUTION.

SOLUTION.

As $21 : 360 = 40 \times 9$, or as $7 : 120 ::$

$$\begin{cases} 12 : \frac{12 \times 120}{7} = \frac{1440}{7} = \text{the prod. of A's stock and time,} \\ 15 : \frac{15 \times 120}{7} = \frac{1800}{7} = \text{- - - B's - - - -} \end{cases}$$

$$\text{Then} \begin{cases} \frac{1440}{7 \times 6} = \frac{240}{7} = \text{A's stock,} \\ \frac{1800}{7 \times 5} = \frac{360}{7} = \text{B's stock.} \end{cases}$$

Lastly $\frac{240}{7} + \frac{360}{7} + 40 = \frac{600}{7} + 40 = 85\frac{5}{7} + 40 = 125\frac{5}{7}$ = the sum of all their stocks, as required.

QUESTION 61.

A had 12 pipes of wine, which he parted with to B at $4\frac{1}{2}$ *per cent.* profit, who sold them to C for 40l. 12s. advantage; C made them over to D for 605l. 10s. and cleared thereby 6 *per cent.* How much a gallon did this wine cost A? — — *Ans.* 6s. $8\frac{6640}{11077}$d.

SOLUTION.

The 12 pipes cost D 605l. 10s.

Therefore as $106 : 100$, or as $53 : 50 :: 605\frac{1}{2} = \frac{1211}{2} : \frac{1211 \times 50}{2 \times 53} = \frac{30275}{53}$ = the sum they cost C.

Consequently $\frac{30275}{53} - 40\frac{3}{5} = \frac{30275}{53} - \frac{203}{5} = \frac{151375 - 10759}{265} = \frac{140616}{265}$ = the sum they cost B.

Hence as $104\frac{1}{2} = \frac{209}{2} : 100 :: 209 : 200 :: \frac{140616}{265} : \frac{140616 \times 40}{53 \times 209} = \frac{5624640}{11077}$ = the sum the 12 pipes cost A.

The 12th part of this is $\frac{468720}{11077}$ = the price of 1 pipe [or 126 gallons.

Divide

Divide now the numerator by 126, or by its component parts 2, 9, and 7; and laſtly divide by the denominator, for the anſwer, thus:

2)468720
9)234360
7) 26040
11077) 3720 (ol. 6s. $8\frac{6640}{11077}$d. the price *per* gallon, req.
20

74400 (6s.
7938
12

95256 ($8\frac{6640}{11077}$d.
6640

QUESTION 62.

A, of Amſterdam, orders B of London to remit to C of Paris, at $52\frac{1}{2}$d. ſter. a crown, and to draw on D, of Antwerp, for the value, at $34\frac{1}{2}$s. flem. a l. ſter. but as ſoon as B received the commiſſion, the exchange was on Paris at 53d. a crown: Pray at what rate of exchange ought B to draw on D, to execute his orders, and be no loſer?

Anſ. 34s. $2\frac{5}{53}$d.

SOLUTION.

$$\text{As } 53 : 52\tfrac{1}{2} = \frac{105}{2} :: 34\tfrac{1}{2} = \frac{69}{2} : \frac{69 \times 105}{2 \times 2 \times 53} =$$

$\frac{7245}{212} = 34$s. $2\frac{5}{53}$d. the anſwer required.

212)7245(34s.
885
37
12

444($2\frac{20}{212} = 2\frac{5}{53}$d.
20

QUESTION

QUESTION 63.

A, with intention to clear 20 guineas, on a bargain with B, rates hops at 15d. a lb. which coſt him $10\frac{1}{2}$d. B, apprized of that, ſets down malt, which coſt 20s. a quarter, at an adequate price: For how much malt did they contract? — — *Anſ.* 49 qrs.

SOLUTION.

As $10\frac{1}{2} = \frac{21}{2} : 15 - 10\frac{1}{2} = 4\frac{1}{2} = \frac{9}{2} :: 20 : \frac{20 \times 3}{7}$ s.

$= \frac{3}{7}$ l. = the gain *per* quarter.

Then, as $\frac{3}{7} : 21 :: 1 : \frac{21 \times 7}{3} = 49$ the number of quarters required.

QUESTION 64.

A and B venturing equal ſums of money, clear by joint trade 180l. By agreement, A was to have 8 *per cent.* becauſe he ſpent time in the execution of the project, and B was to have only 5: What was allotted to A for his trouble? — *Anſ.* 41l. 10s. $9\frac{3}{13}$d.

SOLUTION.

As $13 = 8 + 5 : 3 = 8 - 5 :: 180 : \frac{180 \times 3}{13} = \frac{540}{13}$

= 41l. 10s. $9\frac{3}{13}$d. the anſwer required.

QUESTION 65.

Laid out in a lot of muſlin 500l. upon examination of which, 3 parts in 9 proved damaged, ſo that I could make but 5s. a yard of the ſame; and by ſo doing find I loſt 50l. by it. At what rate *per* ell am I to part with the undamaged muſlin, in order to gain 50l. upon the whole?

Anſ. 11s. $7\frac{2}{7}$d.

SOLUTION.

SOLUTION.

In order to gain 50l. by the whole, he must gain 100l. by the undamaged part, because he lost 50l. by the part which was damaged.

Now the part damaged was $\frac{1}{3}$, and the rest $\frac{2}{3}$; also the whole cost 500l.; the $\frac{1}{3}$ of which is $166\frac{2}{3}$, and the $\frac{2}{3}$ of it is $333\frac{1}{3}$. Consequently the damaged part was sold for $166\frac{2}{3} - 50$ or $116\frac{2}{3}$; and the sound part must be sold for $433\frac{1}{3} = 333\frac{1}{3} + 100$.

But the damaged part sold at 5s. *per* yard, therefore as 5s. or $\frac{1}{4}$l. : $116\frac{2}{3}$l. : : 1 yd. : $116\frac{2}{3} \times 4 = 466\frac{2}{3}$ yards, the quantity which was damaged. And the double of it, or $933\frac{1}{3}$ yards was the undamaged part, which must sell for $433\frac{1}{3}$l. Therefore as $933\frac{1}{3} : 1 : : 433\frac{1}{3} : \frac{433\frac{1}{3}}{933\frac{1}{3}} =$ (by multiplying the terms both by 3) $\frac{1300}{2800} = \frac{13}{28}$l. the price *per* yard.

And consequently, as $4 : 5 : : \frac{13}{28} : \frac{13 \times 5}{28 \times 4} = \frac{65}{112}$l. $= \frac{65 \times 20}{112}$s. $= \frac{65 \times 5}{28} = \frac{325}{28} = 11\frac{17}{28}$s. $=$ 11s. $7\frac{2}{7}$d. the price *per* ell required.

OTHERWISE.

Since the sound part is the double of the part damaged, and the former must gain a sum just the double of that which was lost by the latter, it is evident that *it* must be sold at a rate as much above the prime cost, as the other was below it.

Now the loss on $\frac{1}{3}$ part was 50l. at which rate the whole 500 would have brought only 350; therefore as 350 : 500, or as 7 : 10 : : 5s. : $\frac{50}{7} = 7\frac{1}{7}$s. the prime cost [*per* yard.

Hence $7\frac{1}{7} - 5 = 2\frac{1}{7} =$ the loss *per* yard on the damaged part, and $7\frac{1}{7} + 2\frac{1}{7} = 9\frac{2}{7}$s. the price *per* yard of the sound part.

Lastly,

Laſtly, as $4 : 5 :: 9\frac{2}{7} : 9\frac{2}{7} \times \frac{5}{4} = \frac{65}{7} \times \frac{5}{4} = \frac{325}{28}$ s. the price *per* ell, the ſame as before.

QUESTION 66.

A, at Paris, draws on B in London, 1400 crowns, at 56d. ſter. a crown, for the value of which B draws again on A at 57d. ſterl. a crown, beſides reckoning commiſſion $\frac{1}{2}$ *per cent*. Did A gain or loſe by this tranſaction, and what? — *Anſ.* He gained $17\frac{13}{19}$ crowns.

SOLUTION.

Firſt, $1400 \times 56 = 78400$ pence, the value of A's draft on B.

Then as $100 : 100\frac{1}{2}$, or as $200 : 201 :: 78400 : 392 \times 201$d. = the ſum that B muſt draw for at 57d. *per* crown.

Therefore as $57 : 1 :: 392 \times 201 : \frac{392 \times 201}{57} = \frac{392 \times 67}{19} = \frac{26264}{19} = 1382\frac{6}{19}$ crowns which B muſt draw for.

Conſequently $1400 - 1382\frac{6}{19} = 17\frac{13}{19}$ crowns is A's gain.

392
67
2744
2352

19)26264 (1382 $\frac{6}{19}$ crowns, ſubtr. from
72 1400
156
44 leaves $17\frac{13}{19}$ the anſwer.
6

QUESTION 67.

A, B, and C are in company; A put in his ſhare of the ſtock for 6 months, and laid claim to $\frac{1}{6}$ of the profits; B put in his for 9 months; C advanced 500l. for 8 months, and required on the balance $\frac{3}{5}$ of the gain: Required the ſtock of the other two adventurers?

Anſ. *A* 185l. 3s. $8\frac{4}{9}$d. and *B* 172l. 16s. $9\frac{13}{27}$d.

SOLUTION.

Firſt $\frac{1}{6} + \frac{3}{5} = \frac{5}{30} + \frac{18}{30} = \frac{23}{30}$ the ſum of the ſhares of the gain of A and C.

Conſeq. $1 - \frac{23}{30} = \frac{7}{30} =$ the ſhare of B. And the gains of A, B, C are reſpectively proportional to the numbers 5, 7, 18.

But the gains are as the products of the ſtocks and times, and the product of C's ſtock and time is $4000 = 500 \times 8$. Therefore

$$\text{as } 18 : 4000 \text{ or as } 9 : 2000 :: \begin{cases} 5 : \frac{10000}{9} = \text{the prod. of A's ſtock and time,} \\ 7 : \frac{14000}{9} = \text{- - - B's - - - .} \end{cases}$$

Theſe being divided by their reſpective times, which are 6 and 9 months, we have

$$\begin{cases} \frac{10000}{6 \times 9} = \frac{1666\text{l. } 13\text{s. } 4\text{d.}}{9} = 185\text{l. } 3\text{s. } 8\frac{4}{9}\text{d.} = \text{A's ſtock,} \\ \frac{14000}{9 \times 9} = \frac{1555\text{l. } 11\text{s. } 1\frac{1}{3}\text{d.}}{9} = 172\text{l. } 16\text{s. } 9\frac{13}{27}\text{d.} = \text{B's ſtock.} \end{cases}$$

QUESTION 68.

A young hare ſtarts 40 yards before a greyhound, and is not perceived by him till ſhe has been up 40 ſeconds; ſhe ſcuds away at the rate of 10 miles an hour, and the

dog,

dog, on view, makes after her at the rate of 18: How long will the courſe hold, and what ground will be run over, beginning with the out-ſetting of the dog?

Anſ. $60\frac{5}{22}$ ſec. and 530 yards run.

SOLUTION.

Firſt $60 \times 60 = 3600 =$ the number of ſeconds in an hour. And 1760 yards are a mile. Therefore as $3600 : 40$, or as $90 : 1 :: 1760 \times 10 : \frac{1760}{9} =$ the yards run by the hare before the dog ſtarts. Conſequently $40 + \frac{1760}{9} = \frac{360 + 1760}{9} = \frac{2120}{9} =$ the diſtance of the hare before the dog when he ſtarts, and which therefore he muſt run more than ſhe in order to overtake her.

But in 1 hour or 3600 ſeconds, the dog runs 8 miles or 8×1760 yards more than the hare. Therefore, as $8 \times 1760 : \frac{2120}{9} :: 3600 : \frac{3600 \times 2120}{9 \times 8 \times 1760} = \frac{400 \times 212}{8 \times 176} = \frac{50 \times 53}{44} = \frac{2650}{44} = \frac{1325}{22} = 60\frac{5}{22}$ ſeconds, the time of the dog's running.

And conſequently as $3600 : \frac{1325}{22} :: 18 \times 1760 : \frac{1760 \times 18 \times 1325}{22 \times 3600} = \frac{8 \times 1325}{20} = 2 \times 265 = 530$ yds. the whole ſpace run by the dog.

QUESTION 69.

If A leave Exeter at 8 o'clock on Monday morning for London, and ride at the rate of 3 miles an hour without intermiſſion; and B ſet out from London for Exeter at 4 the ſame evening, and ride 4 miles an hour conſtantly:

Suppoſing the diſtance between the two cities be 130 miles, whereabout on the road ſhall they meet?

Anſ. $69\frac{3}{7}$ miles from Exeter.

SOLUTION.

From 8 o'clock till 4 o'clock, are 8 hours. Therefore $8 \times 3 = 24$ are the miles rode by A before B ſets out from London. And conſequently $130 - 24 = 106$ are the miles to travel between them after that.

Hence, as $7 = 3 + 4 : 3 :: 106 : \frac{318}{7} = 45\frac{3}{7}$ miles more travelled by A at the meeting.

Conſequently $24 + 45\frac{3}{7} = 69\frac{3}{7}$ miles from Exeter is the place of their meeting.

QUESTION 70.

A reſervoir for water has two cocks to ſupply it; by the firſt alone it may be filled in 40 minutes, by the ſecond in 50 min. and it hath a diſcharging cock, by which it may, when full, be emptied in 25 min. Now, ſuppoſing that theſe 3 cocks are all left open, and that the water comes in; in what time, ſuppoſing the influx and efflux of the water to be always alike, would the ciſtern be filled? — — *Anſ.* 3 hrs. 20 min.

SOLUTION.

The rates of running are reciprocally as the times of filling. Therefore the rate of increaſe of the influx over the efflux, is as $\frac{1}{40} + \frac{1}{50} - \frac{1}{25} = \frac{5+4-8}{200} = \frac{1}{200}$, which rate of increaſe is alſo reciprocally as the time of filling.

Therefore the whole time of filling, is $\frac{200}{1}$ minutes, or 3 hours 20 minutes = the anſwer required.

QUESTION

QUESTION 71.

A ſets out of London for Lincoln, at the very ſame time that B at Lincoln ſets forward for London, diſtant 100 miles: After 7 hours they meet on the road, and it then appeared that A had road $1\frac{1}{2}$ miles an hour more than B. At what rate an hour did each of them travel?

Anſ. A $7\frac{25}{28}$, and B $6\frac{11}{28}$ miles.

SOLUTION.

Firſt, $7 \times 1\frac{1}{2} = 10\frac{1}{2}$ miles which A travels more than B.

Hence $\frac{100 + 10\frac{1}{2}}{2} = \frac{110\frac{1}{2}}{2} = 55\frac{1}{4}$ travelled by A,

And $\frac{100 - 10\frac{1}{2}}{2} = \frac{89\frac{1}{2}}{2} = 44\frac{3}{4}$ - - - - - - B.

Then dividing each diſtance by 7, the time of travelling, we have

$$\begin{cases} \frac{55\frac{1}{4}}{7} = 7\frac{25}{28} = \text{A's rate of travelling,} \\ \frac{44\frac{3}{4}}{7} = 6\frac{11}{28} = \text{B's - - - - - -.} \end{cases}$$

QUESTION 72.

A and B truck; A has $12\frac{1}{2}$ cwt. of Farnham hops, at 2l. 16s. a cwt. but in barter inſiſts on 3l. B has wine worth 5s. a gal. which he raiſes in proportion to A's demand. On the balance A received but a hhd. of wine: What had he in ready money? — *Anſ.* 20l. 12s. 6d.

SOLUTION.

Firſt, $12\frac{1}{2} \times 3 = 37\frac{1}{2}$l. = 37l. 10s. is the amount of the hops.

But as 2l. 16s. $= 2\frac{4}{5}$l. : 3l. : : 5s. : $\frac{5 \times 3 \times 5}{14} = \frac{75}{14}$s. = the barter price *per* gallon of the wine. Therefore $\frac{75}{14} \times 63 = \frac{75 \times 9}{2} = \frac{675}{2}$s. $= \frac{675}{40}$l. $= \frac{135}{8}$l. = 16l. 17s. 6d. is the value of the hogſhead of wine.

Conſequently the difference, or 37l. 10s. — 16l. 17s. 6d. = 20l. 12s. 6d. is the ſum given in money.

QUESTION 73.

A, of Amſterdam, owes to B, of Paris, 3000 guilders of current ſpecie, which he is to remit to him, by order, the exchange 91d. Flem. *de banco* a crown, the agio 4 *per cent.* but when this was to be negotiated, the exchange was down at 90d. a crown, and the agio 5 *per cent.* What did B get by this turn of affairs?

Anſ. 5 liv. 12 ſol. $8\frac{584}{1183}$ den.

SOLUTION.

Firſt, 3000 guilders $= 3000 \times 40 = 120000$ pence, currency.

And as 104 : 100 : : 120000 : $\frac{12000000}{104} = \frac{1500000}{13}$d. [banco.

Then as 91 : $\frac{1500000}{13}$: : 1 cr. : $\frac{1500000}{13 \times 91} = \frac{1500000}{1183}$ crowns, the amount at the firſt exchange.

Again, as 105 : 100, or as 21 : 20 : : 1200000 : $\frac{800000}{7}$d. banco.

Then as 90 : $\frac{800000}{7}$: : 1 cr. : $\frac{80000}{63}$ crowns, the amount by the latter exchange.

The

The difference, or $\frac{80000}{63} - \frac{1500000}{1183} = \frac{169\times80000}{169\times63} - \frac{9\times1500000}{9\times1183} = \frac{13520000-13500000}{10647} = \frac{20000}{10647}$ cr. $= \frac{20000}{3549}$ liv. $=$ 5 liv. 12 ſol. $8\frac{584}{1183}$ den. is the ſum gained by B.

3549)20000(5 liv.
2255
20

45100(12 ſols
9610
2512
12

30144($8\frac{1752}{3549} = 8\frac{584}{1183}$ den.
1752

FINIS.

ERRATUM.

In the note to the equation of payments, (in the Arithmetic) containing Malcolm's rule, the remark concerning a greater number of payments than two, ſhould be omitted, as that method of equating for 3 or more payments, will not give the anſwer ſtrictly true. But in all ſuch caſes, to obtain the juſt anſwer, Malcolm's General Principle of Solution ought to be uſed, *viz.* making the intereſts of the ſums that are kept till after they are due, equal to the diſcounts of thoſe which are paid before they are due. The reſolution of the reſulting equation will indeed require ſome knowledge in Algebra; but for ordinary purpoſes, the rule in common uſe will bring out anſwers ſufficiently near the truth.

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